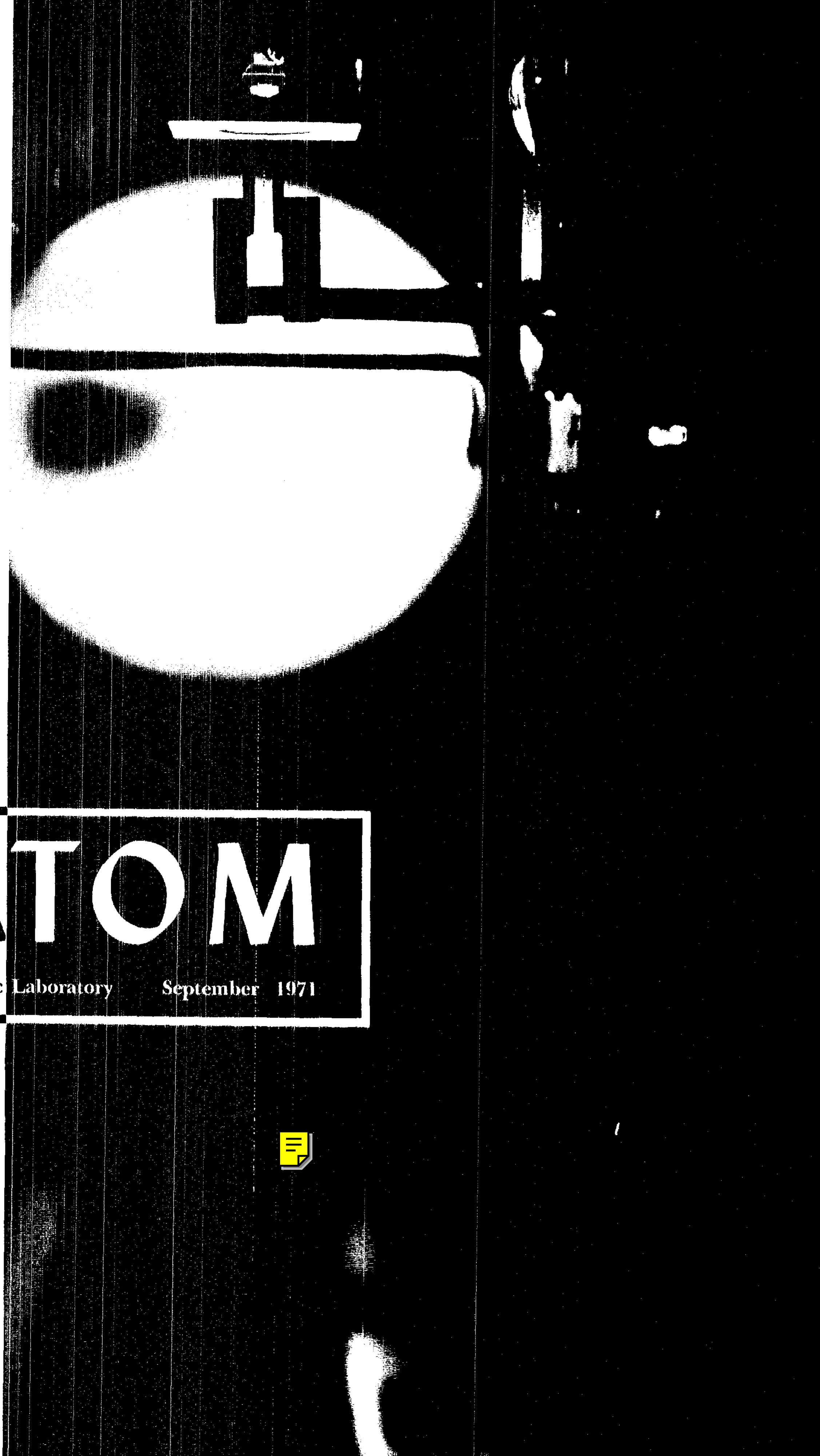
THE ATOM

Los Alamos Scientific Laboratory September 1971

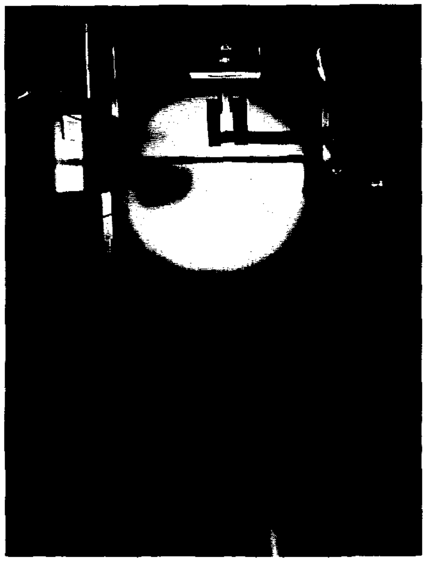


Volume 8 Number 7
September, 1971

THE ATOM

Published monthly except for July-August and January-February issues by the University of California, Los Alamos Scientific Laboratory, Office of Public Information, P. O. Box 1663, Los Alamos, New Mexico 87544. Second Class Postage Paid at Los Alamos.

CONTENTS:



COVER:

The cover photograph shows a stream of thousands of uniform sized droplets per second, photographed by ISD-7's Bill Jack Rodgers against a pulsating light unit. The droplets play an important role in a system being developed by members of H-4 for the detection of cervical cancer and other abnormal cells. More information is contained in Barbara Storms' story which begins on page one.

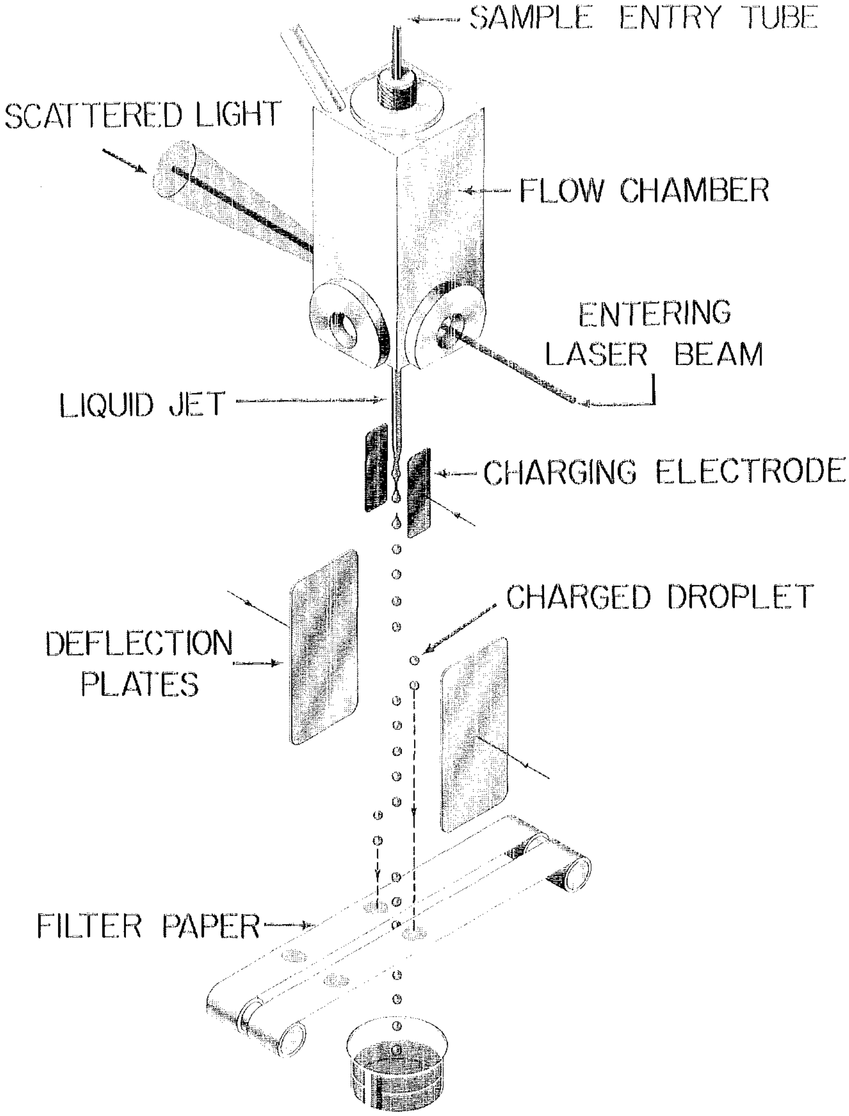
Editor: Kenneth J. Johnson
Photography: Bill Jack Rodgers

Office: D-413 Administration Building. Telephone: 667-6102. Printed by the University of New Mexico Printing Plant, Albuquerque.

LASL's search for better methods of detecting cervical cancer cells and other abnormalities is showing good progress with a machine called

The Cell Sorter

This artist's conception shows the mechanics of the cell sorter from the time a sample enters its flow chamber until abnormal cells are charged and deflected onto filter paper.



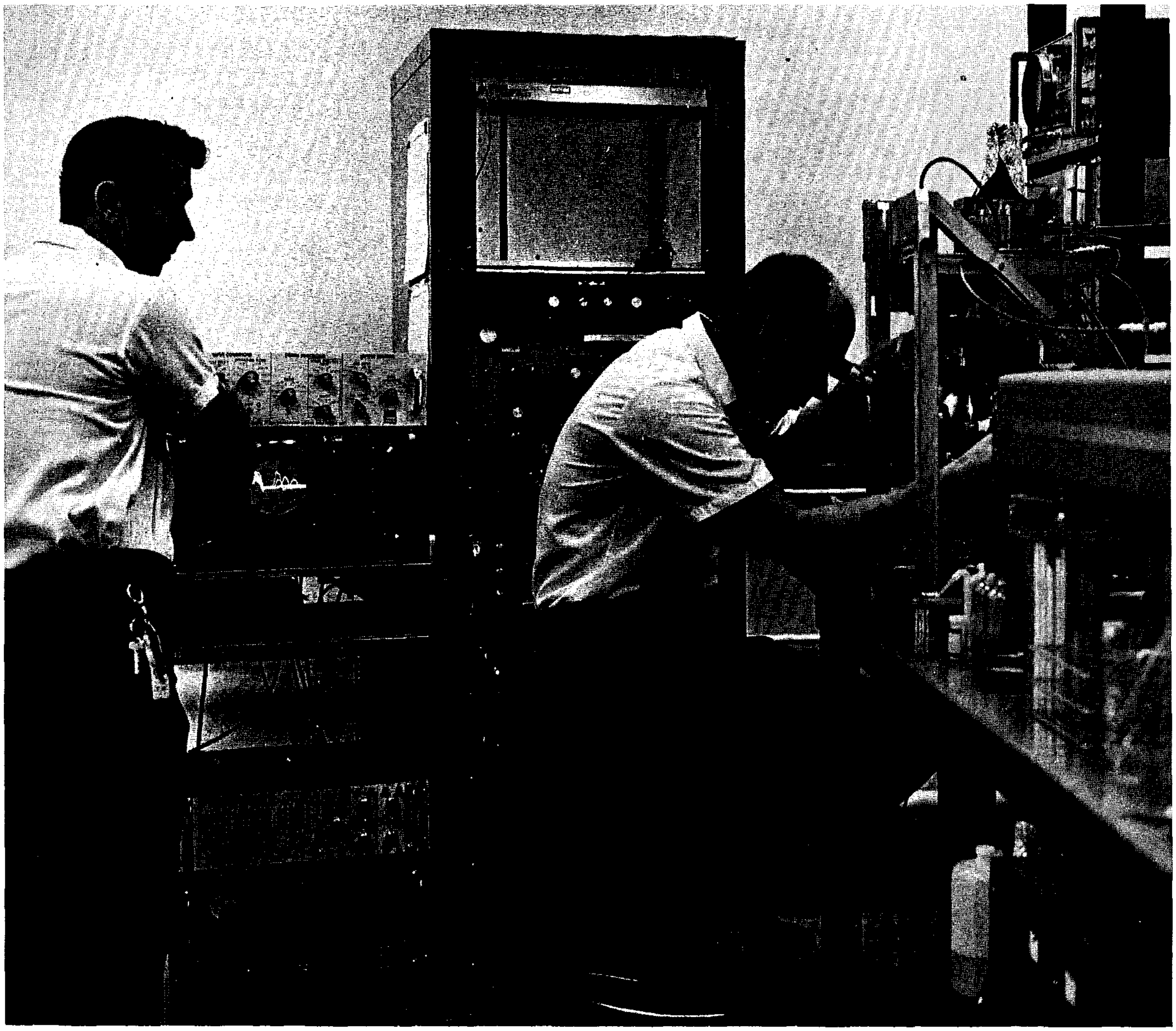
By Barbara Storms

A unique system for high-speed, automatic detection of abnormal cells now under investigation at LASL's Health Research Laboratory could someday make such tests as the Papanicolaou or "Pap" smear for cervical cancer faster, cheaper and more universally available. But there is still a long way to go, according to Mack Fulwyler, H-4, who heads the project being conducted under the joint auspices of the National Cancer Institute and the Atomic Energy Commission. Other LASL people involved in the project include Marvin Van Dilla, Paul Mullaney, Scott Cram, John Steinkamp, Dale Holm and Jim Coulter, all of H-4, and Dr. Michael Stewart, consulting pathologist from the Los Alamos Medical Center. Cytotechnician Angela Romero and Instrumentation Technician John Horney have recently joined the staff to take part in the work.

The heart of the system under development is a machine known as the multi-sensor cell sorter which represents a combination of several separate techniques, each of which is a bold departure from traditional techniques of cytology and each of which has been developed as a result of H-4's increasing interest in biological cell research over the past six years.

Standard procedure for the Pap test requires obtaining cells from the cervix and vagina which are then placed on a glass microscope slide, fixed, stained and examined by a cytotechnician. Slides with cells judged to be abnormal are then set aside for further examination by a pathologist. Although the

continued on next page



system works well enough to be the standard against which new methods must be compared, it is time-consuming and costly. It is also non-quantitative in that determination of abnormal cells is based entirely on the technician's "eyeball" estimations.

In the new method, cells are dispersed and suspended in a liquid which flows past electronic and optical sensors where specific properties of each cell are quantitatively measured. Cells found to be suspicious are automatically sorted out and set aside for visual examination. The time required to analyze and sort a single cell is between 100 and 200 microseconds, making it possible to analyze 50,000 cells per minute.

As Fulwyler sees it, such high speed automation could be incorporated in large health testing and screening centers, thus lowering the cost and making the Pap and other cytological tests more readily available without overtaxing the already inadequate medical facilities.

"But the fact that this has never been done before offers both the promise and the hang-up," says Fulwyler. While the sensing and sorting capabilities have already been proved, the measurable characteristics that distinguish abnormal cells from normal ones are not yet definitely established.

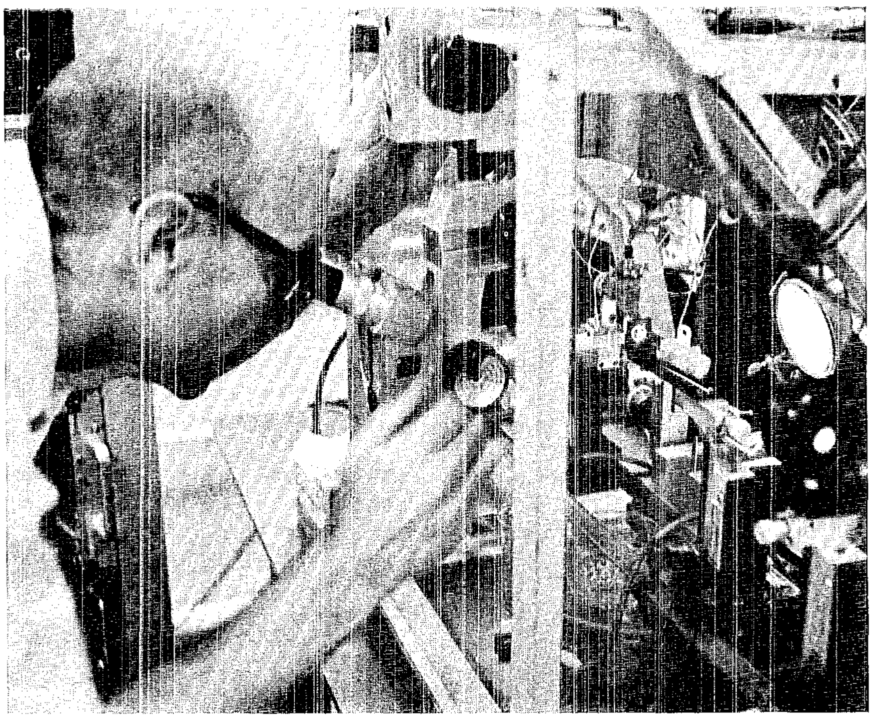
John Horney, left, and John Steinkamp put the cell sorter through its paces at the Health Research Laboratory.

"That's why," Fulwyler points out, "the project's only goal is 'proof of principle.' If we can do it—if we can find the way to say this cell is malignant, this one is not—all the rest becomes possible."

Some investigators have determined that malignant cells associated with cancer are frequently larger than normal cells and others find malignant cells often contain large amounts of DNA. It is upon these properties that the biophysicists are concentrating their initial efforts.

Analysis of the cell follows these steps. The suspended cell passes through a volume-sensing orifice generating a signal proportional to cell volume. This signal is stored temporarily. The cell then passes through an argon-ion laser beam where the light scattered from the beam is collected and measured, giving a second signal telling of cell shape, size or nuclear size. At the same time fluorescent dyes bound to materials in the cell are excited to emit light, which is measured, generating a third signal indicating the amount of stain, and, therefore, of stained material contained in the cell.

Mack Fulwyler checks the uniformity of droplets coming out of the flow chamber.



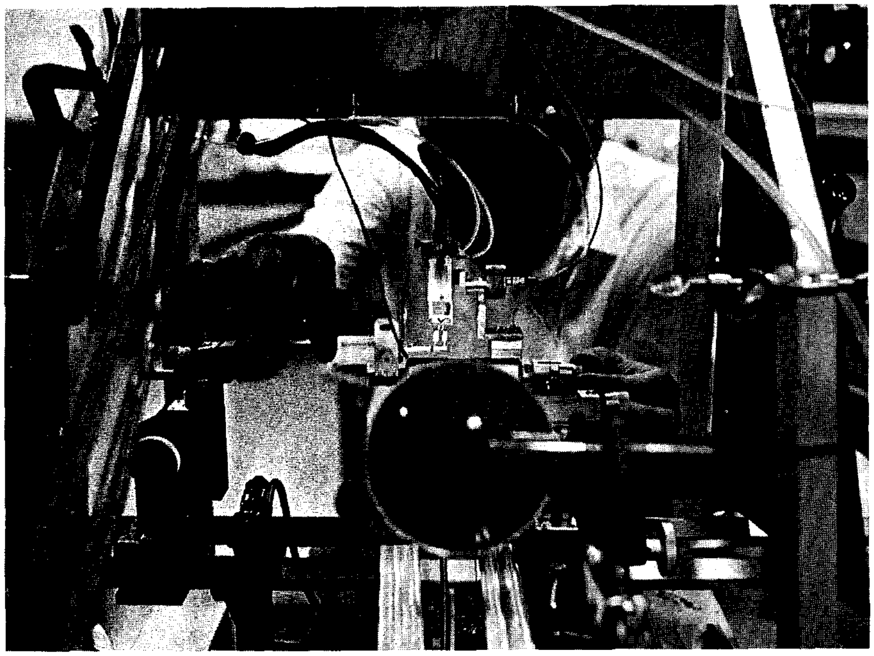
Most frequently used dye is fluorescent Feulgen which bonds itself only to the DNA within the cell so that the amount of fluorescent light determines the amount of DNA present. Another possibility is the use of acridine orange which stains the nucleus green and the cytoplasm red providing the potential for measuring DNA and RNA simultaneously.

As the three signals, representing cell volume, shape and DNA content are brought out, processed and compared with pre-determined criteria of normality, the cell suspension jets into the air. As the suspension jets out, disturbances caused by a vibrating piezo-electric crystal cause the jet to break into thousands of uniform sized droplets per second. Although not every droplet captures a cell, each cell in the suspension is caught and isolated in a single droplet. The droplets containing abnormal cells can then be charged and deflected onto filter paper. Normal cells also can be deflected and held to provide the pathologist with a reference to aid his interpretation.

Cell samples for the project come from large hospitals around the country as well as from the Los Alamos Medical Center and are the responsibility of the National Cancer Institute in Bethesda, Md. While LASL workers concentrate on the instrumentation, NCI researchers, under the direction of Dr. Richard Malmgren, are tackling other problems connected with automatic flow-systems analysis such as development of reliable methods for staining and for producing mucus-free cell suspensions in which cells are kept adequately separated.

Meanwhile, in Los Alamos, Dale Holm is improving laser beam techniques to enable the cell sorter to spot pairs or groups of cells passing through its beam. Squeezed from its usual 30-micron diameter to a 5-micron-wide ribbon, Holm's laser beam not only picks up the connections between cells but is capable of

continued on next page



Steinkamp adjusts the stream of droplets coming out of the cell sorter's flow chamber.

Cytotechnician Angela Romero consults with Fulwyler on a dyed sample she is viewing through the microscope.

distinguishing cytoplasm from the nucleus as the cell passes through. Another variation in the works is reduction of the beam to a spot about one micron in diameter which scans back and forth across the cell producing a coarse image of the cell.

If the multi-sensor cell sorter is proven feasible as a detector of cervical cancer cells, Fulwyler forsees its adaptation for a variety of uses including detection of malignant cells in sputum and stomach washings, for analysis of white blood cells and detection of parasites in red blood cells.

Other medically-oriented projects using variations of the same techniques are already underway in H-4. Under a brand-new contract with the U.S. Department of Agriculture, Van Dilla, Mullaney, Ted Trujillo, Cram, and Holm and Coleman Hensley, project officer for the USDA, are attempting to prove the feasibility of an automated system of fluorescent cell analysis for diagnosis of viral diseases in animals.

In this method, fluorescently-labelled antibodies injected into a cell suspension from an animal will attach themselves to infected cells. Measurements of cell fluorescence would indicate whether or not an animal has been exposed to the disease and to what degree. Currently concentrating on detection of hog cholera, Van Dilla hopes to initiate an accelerated program to include Venezuelan equine encephalomyelitis which has recently swept the Southwest.

Under contract with the National Institute of Health, Van Dilla, Trujillo, Cram and Holm are also investigating methods of detecting by fluorescence measurements, deterioration of cells used to grow vaccines.

Vaccines are grown in cultures of living cells which continue to reproduce themselves indefinitely. However, there have been indications that these cells will eventually begin to show changes in chromosome makeup. "We want to find automatic methods for detecting these changes in order to know when to throw them away," Van Dilla said.

"The physics aren't new, the electronics are old fashioned," Fulwyler points out. "It's just that we're applying them to biology in a unique way."

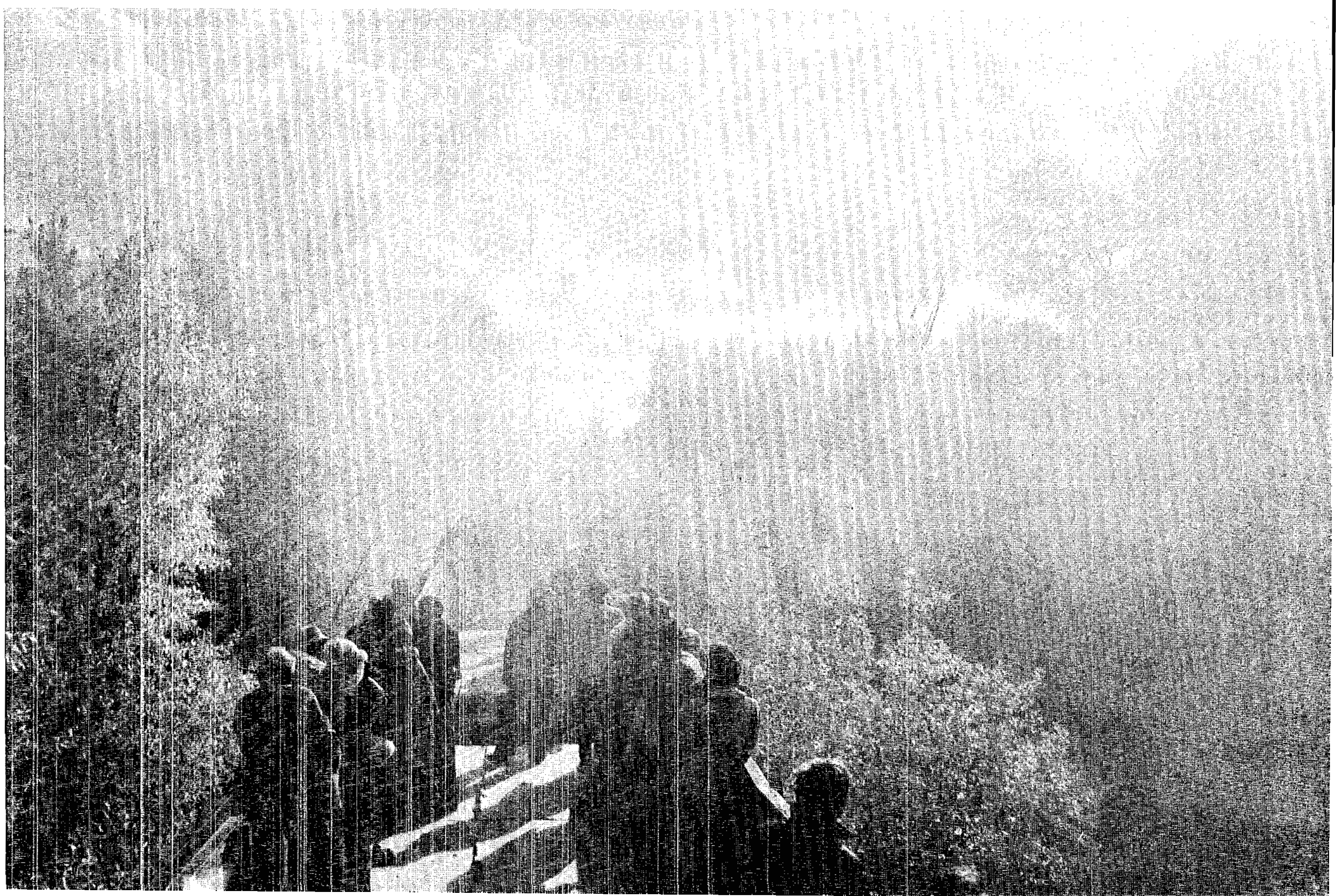
"The many applications of these techniques cannot be forseen clearly at this time," he concludes, "but the promise is great and the future prospects are exciting."

The CATS Tracks

One of the CATS engines nears Lava Siding about 15 miles west of Antonito.

There's been some joking about CATS, the acronym for the Cumbres and Toltec Scenic Railroad. But all joking aside, the small engines pull their rolling stock along the narrow gauge track between Chama, N.M., and Antonito, Colo., because of the sweat of hundreds of volunteers and contributors who fought a five-year battle for its preservation and restoration. How things were and how they are now are told through the camera-eye of Bill Jack Rodgers on the following pages.

Wind carries smoke from the engine back to the gondola cars in which volunteers were taken to various worksites.

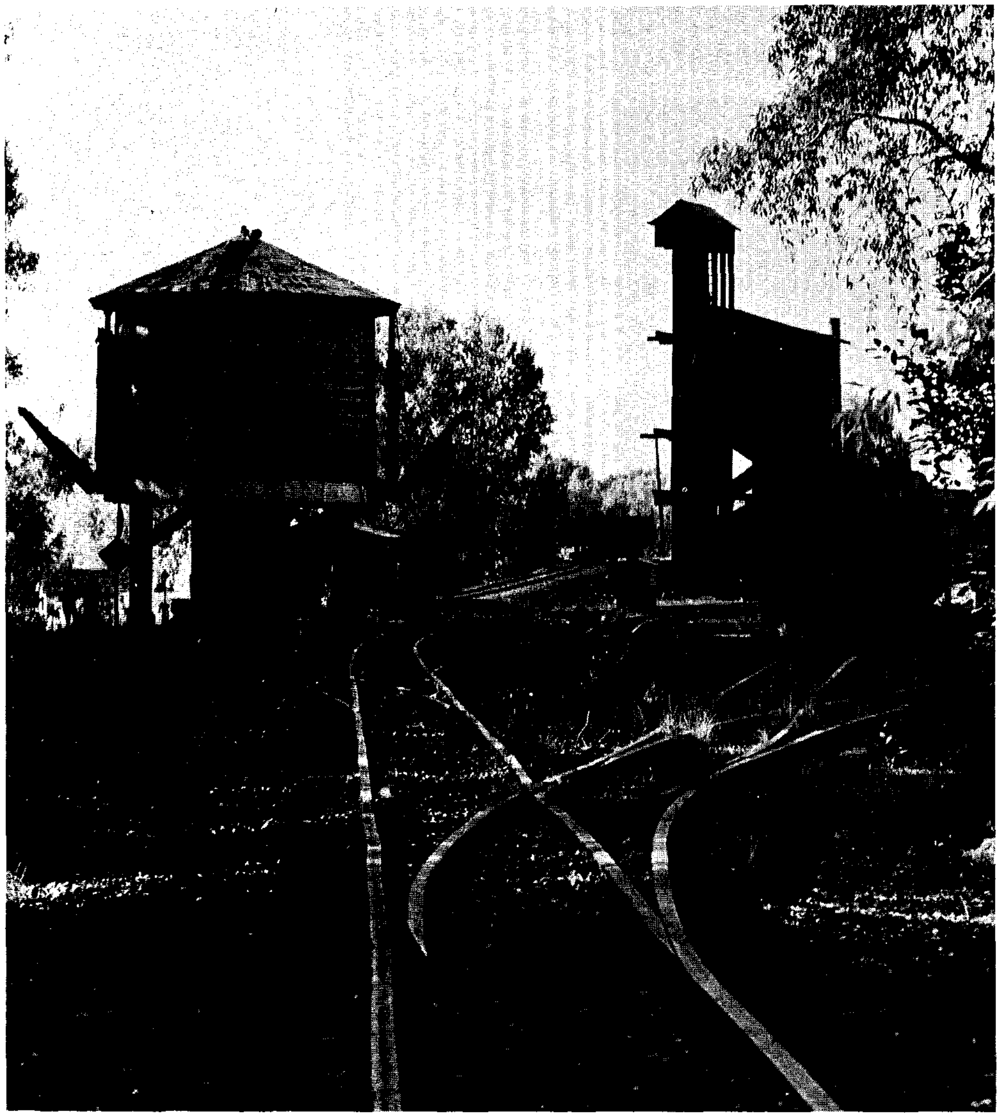


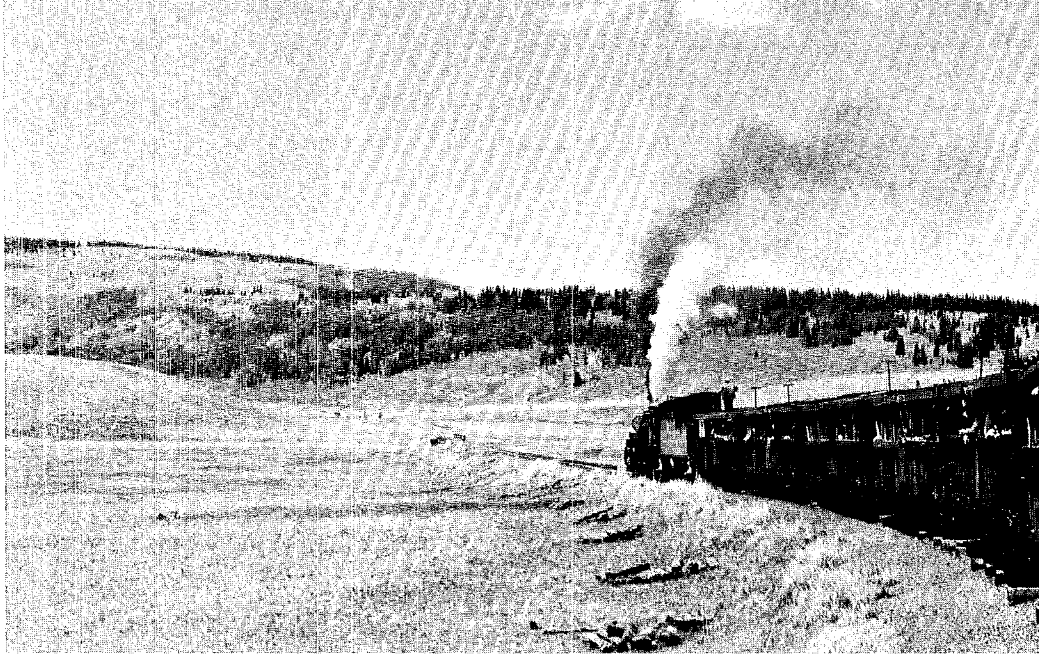
Among volunteer workers who contributed time to the restoration of the 90-year-old railroad were several from the Los Alamos Scientific Laboratory and townsite. These include John Pritchard, H-5, Dick Glass, ENG-5, George Swain, MP-1, Bob Jameson and Don Liska, both of MP-2, and George Wagoner, GMX-3, who learned the hard way what it's like to repair and install track. Bill Stocum, H-5, helped paint passenger cars and with Swain wrote the descriptive booklet for the first special excursion run June 26 of this year. Explorer Scout Post 326 from White Rock, led by Al Dross, H-7, and Joe Sul, P-1, cleared brush and cleaned culverts. Bill Jack Rodgers, ISD-7, and Mark McMahon, publisher of the Los Alamos Monitor, provided photographs and publicity, and John Allen and Harold Robinson, both of ENG-7, furnished their small dozer to clear away debris that had collected on the zig-zag track through several months of disuse.

When Engine 483 made its way through the rough and scenic country from Antonito to Chama in September of 1970, it was the first time the track had been used in nearly two years, and was the culmination of the long struggle led by the 500-member Denver and Rio Grande Western Narrow Gauge Railway Preservation Society to keep the train from being abandoned and scrapped.

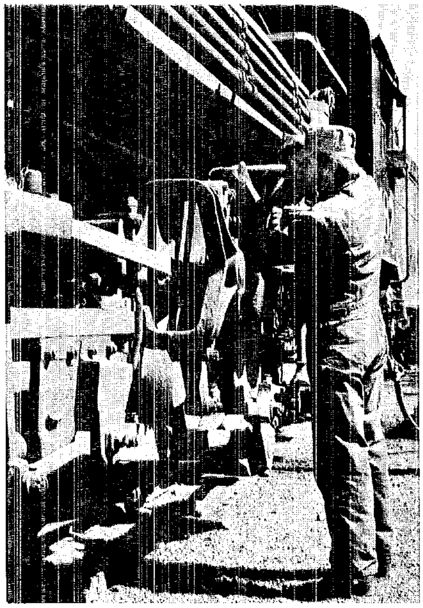
The Denver and Rio Grande Western built the narrow gauge line through the mountain country in 1880. By 1967 they had no further use for the train. Much of its freight business had been converted to motor transport, and passenger service was erratic. As the D&RGW prepared its case for abandonment, the Preservation Society began its fight to preserve the railroad, a part of American history, for future generations to enjoy. The Society gained the support of people across the country which resulted in the joint purchase of 64 miles of track, nine locomotives, and 130 cars by the States of New Mexico and Colorado in 1970. After many months and more than 15,000 man-hours of hard work by volunteers, the narrow gauge train began its first tourist excursion trips July 3, 1971. Since then more than 4,000 persons have ridden the Cumbres and Toltec Scenic Railroad.

A pair of volunteer workmen are dwarfed by the water tank and coal tipple at Chama.





Bob Hawes, a former LASL employee, and George Wagoner check the condition of track near Toltec Gorge.



Railroad ties replaced by volunteers lie beside the track near the Los Pinos station.

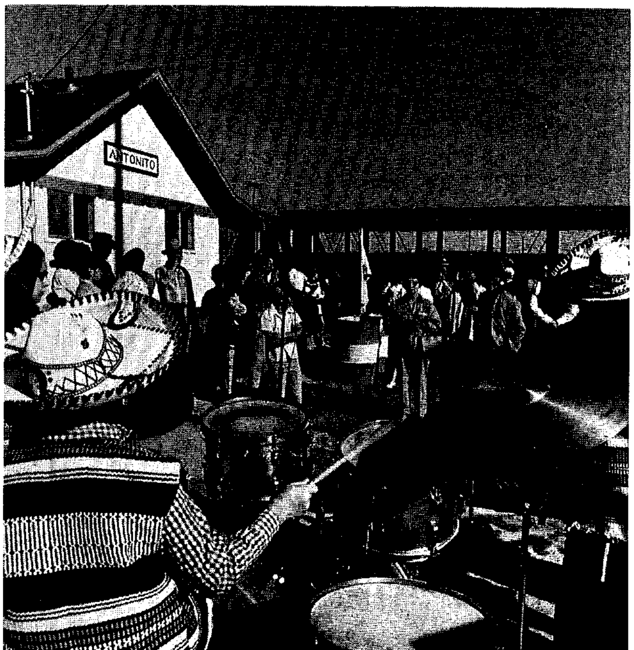
Oiling one of the narrow-gauge locomotives is John Pritchard, H-5.

Eating lunch on the steps of the old Osier Station during one of the first excursions are Vernon Kerr, state representative from Los Alamos, and his wife, upper left; George Pennington, state representative from Pennington County, Colo., left, and his wife, next to Mrs. Kerr; George Swain, H-5, and his wife; and the John Pritchards, right.

Bill Stocum, H-5, looks out one of the passenger cars.

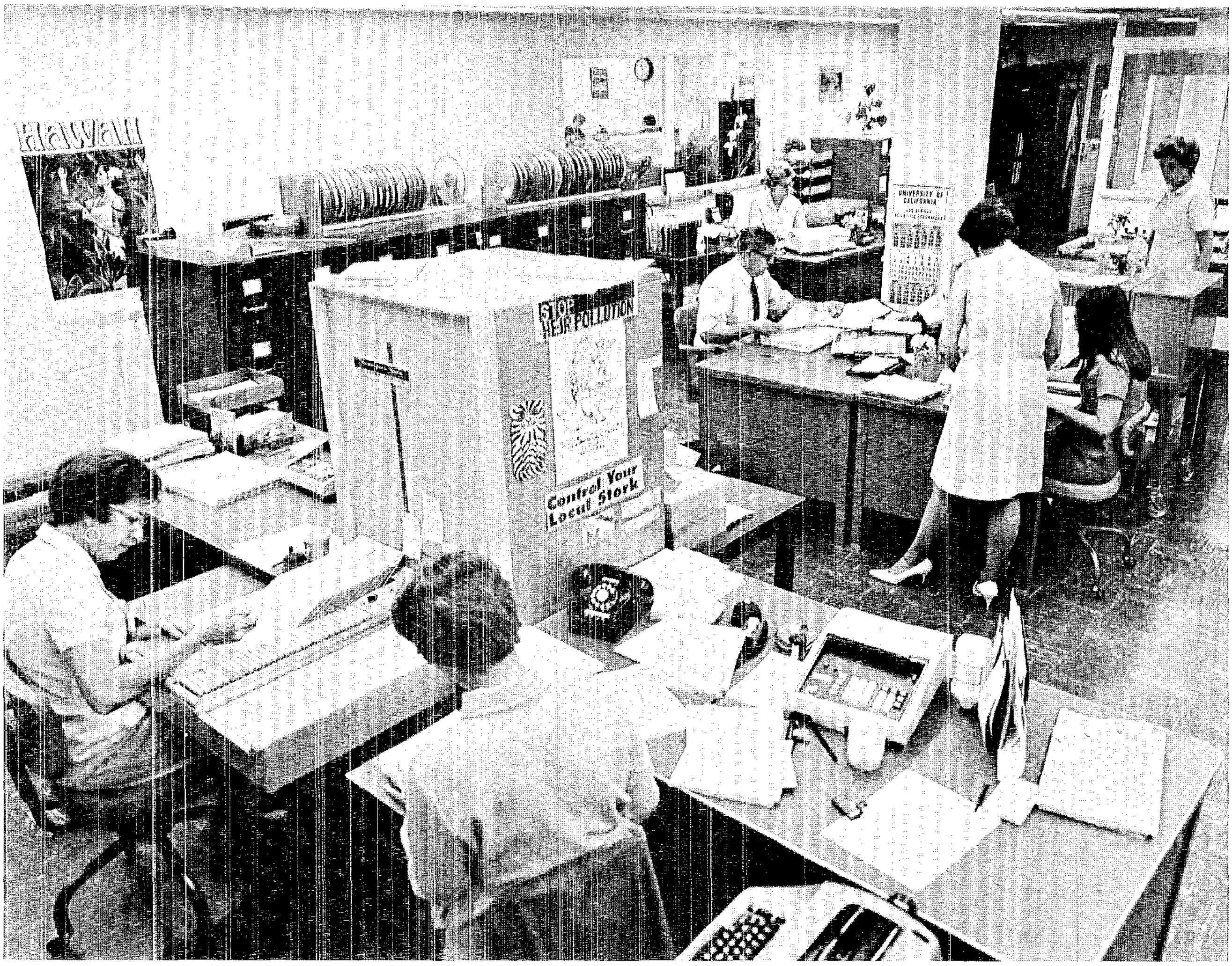
Engine 484 puffs its way over the Cascade Creek Trestle.

A band played before the CATS train left Antonito.



Train buffs and newsmen photograph one of the first excursions to Chama.

Paperwork of the Payroll



Members of AO-2 work on the next payroll.

Time was that figuring a payroll was a simple matter. All the employer needed was a worker's name. He paid the worker a salary and nothing was deducted from it. The worker then paid his medical bills just as he paid his grocer, and savings for retirement were a product of his own planning.

Anymore, payroll is not as simple. A great deal more information than just a name is required for the numerous government and institutional forms and reports relating to such items as state and federal taxes, insurance, social security and retirement systems. There are many deductions to be made—some required and others requested by employees—and funds from these deductions to be distributed.

Meshing these many requirements into a working system has been said to require the help of a mythical octopus whose muscular arms are in motion all the time, collecting, compiling, verifying and distributing information and funds. But people, such as the members of Group AO-2 at the Los Alamos Scientific Laboratory, still do the work.

The group, headed by Ivan (Chick) Bergstein is charged with the administration of prompt and

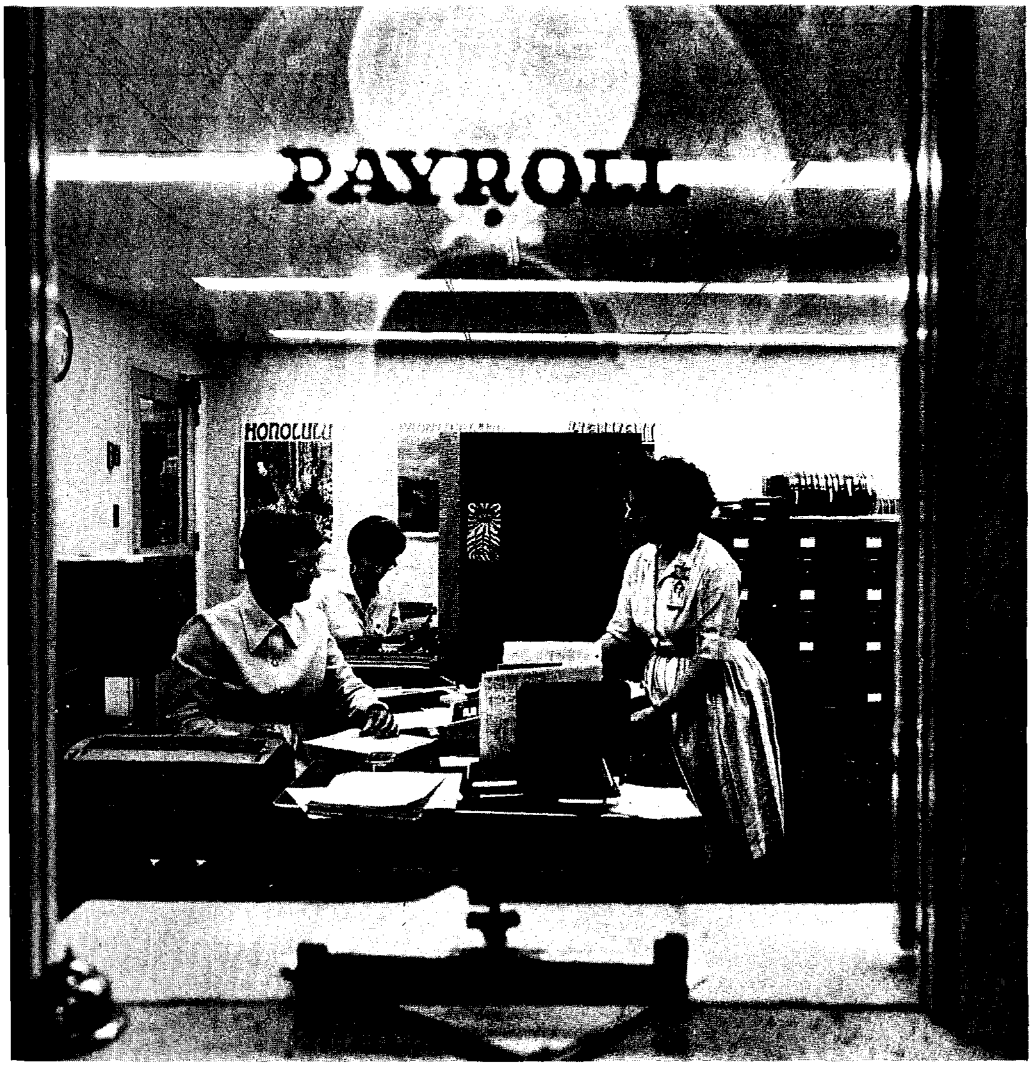
continued on next page

accurate payment and control of LASL payrolls. This responsibility includes the accurate accountability and distribution of deductions withheld, maintenance of sick and vacation records, preparation and distribution of various reports to federal and state governments, the Atomic Energy Commission, the University of California, the Laboratory, the retirement systems and insurance companies, and the counseling of employees on taxes, insurance and retirement as they pertain to the payroll function.

The key to the payroll system is the "master file" which contains 57-plus items of information on every Laboratory employee. The master file is included in the "employee information system," a magnetic tape which holds a composite of all the information on each employee required for use by AO-2, Wage and Salary department and Personnel department. The computer on which the tape is "played" is programmed by AO-7 to produce only those portions of information required by any of the three groups. For example, the computer is programmed to ignore information on monthly paid employees while extracting information to meet the biweekly payroll and vice versa.

The payroll group updates the master file normally twice each week because of the constant heavy influx of changes and to avoid any delay in distributing payrolls. Ten different standardized forms are used in updating the file. The information on them is punched into cards by AO-4 whose members also

Tim Kelley, AO-7 associate group leader, and Ivan Bergstein, AO-2 group leader, discuss changes in the master file. In background are AO-4 Computer Operators Ramona Gonzales and Shirley Loewenstein.



Behind the payroll window, Wilma Bruce talks with Ida Kraig. At center is Anne Powell.

operate the computer. The changes are put into the system and then returned to AO-2 in the form of a printed listing where the information is verified.

Changes made on the master file are divided into two categories. One is known as "personnel actions" and the other is "deductions." Personnel actions pertain to changes in employee status such as vacation, various types of authorized leaves of absence including sick leave, job reclassifications, transfers, pay increases, and new hire information. Deductions, with the exception of those made for taxes, retirement and garnishments, relate to pay deductions requested by employees for such items as insurance, U.S. Savings Bonds, tax-sheltered and non-sheltered fixed and variable annuities, credit union savings accounts, bank checking accounts and tax exemptions.

While employees are, for the most part, responsible for initiating changes in deductions, sources of information for personnel-action changes include the Personnel department, Wage and Salary, all groups at the Laboratory and the employees themselves.

When a person is offered a job by the Laboratory, the Personnel department initiates a Personnel Action form (PA) through Wage and Salary to AO-2. Bergstein's group assigns the person an employee number. If the person rejects the offer the number is deleted. If he accepts, the Personnel department initiates a hiring form which gives the Payroll group the information it needs to place the new hire on the payroll. "This includes the usual biographical information such as date of birth and hire, social security number and rate of pay," Bergstein said. "We verify the information and do the paperwork that has to be done before it is key-punched, and double-check it when it comes out of the system. We used to rate new hires for retirement but since July 1 of this year, 8.1 per cent of gross earnings

continued on next page

Carmel Quintana checks a computer tape of recent changes made in the master file. In background is Mabel Peek.

Thelma Northrup discusses a change card with Fabiola Romero, card puncher in AO-4.

is the contribution rate for all new hires regardless of age or sex."

A major contributor of personnel-action changes is the bi-weekly attendance reports which are submitted by all groups at the Laboratory. Reporting procedures are standardized as outlined in the Laboratory's Manual of Office Procedure. On these reports are recorded attendance, travel, vacation, and various types of leaves of absence. The travel information is checked by Bergstein's group against bills submitted to Group PER-7 which reimburses employees for expenses incurred through official Laboratory business.

The number of changes made in the master file each time it is updated varies considerably so that any attempt at averaging would be distorting. "The number of changes made during the first five months of this year were pretty much routine if you look at each month individually," said Bergstein. The group leader reported that in January one or more changes made for deductions affected 108 persons and that personnel actions affected 705. In this order, the numbers of persons affected in February were 120 and 465; March, 336 and 645; April, 144 and 450; May, 192 and 375.

"June was an extraordinary month," the group leader said, "because of the Laboratory's reduction in force. Checks for the people affected by it and all other terminations were hand-cranked. This takes more time and we have to be careful that we make the right changes in the master file.

"All the changes in the master file are handled as individual items, excluding those of large volume. Merit reviews, for instance, are programmed by AO-7 according to a system worked out between the Payroll group, AO-7, and Wage and Salary. When we have large volume material, Payroll doesn't have as much paperwork to do, although we do verify that what information is put into the system is correct."

Bergstein feels a top-notch payroll system has been built up for the Laboratory over the years, but it hasn't been without problems. "At one time post-doctorates, visiting staff members and EEO (Equal Employment Opportunity) employees were assigned account numbers, but were physically present and working in other groups. They were spread all over the Laboratory and Mail and Records had a difficult time locating them to deliver their checks. There was no one at an account number to accept them. Wage and Salary established 'cost' and 'work' groups for these people and we've worked it into our system." The cost group is the account from which wages are paid and the work group is where they work.

Group AO-2 is made up of eight full-time employees and one summer employee. Three of its members work on the monthly payroll and three, plus the summer employee, work on the bi-weekly (hourly) payroll although all group members contribute time to the latter. The octopus is a myth.

Jon Barnes and Cathy Roybal, AO-2's summer employee, talk over a change in deductions requested by an employee. At right is Thelma Northrup.

Cesium - 145

from a "string and bees wax" experiment

Thomas Wimett, Godiva program director for N-2, talks over reactor requirements with Kurt Wolfsberg of CNC-11 while Silvio Balestrini, CNC-11, and Leon Forman, J-16, make adjustments on the spectrograph's collector plates.

It was a "string and bees wax" experiment according to Silvio Balestrini, a member of Group CNC-11 at the Los Alamos Scientific Laboratory.

Balestrini was describing an experiment he, Kurt Wolfsberg, also of CNC-11, and Leon Forman of J-16, conducted to isolate the isotope, cesium-145. The three Los Alamos scientists and a group of French scientists, working separately, isolated the isotope at about the same time.

What Balestrini meant by a string and bee's wax experiment is that most of the equipment required to conduct it was already available. The only fabrication necessary was the preparation by CMB-6 of a porous-graphite sample impregnated with uranium-235, and a small tantalum oven designed by Balestrini in which to heat it. Other equipment used in the experiment included the Godiva IV fast-burst reactor and conventional mass spectrograph and beta counters.

Intense bursts of intense neutrons from the Godiva reactor were moderated and used to fission the uranium in the sample which was heated by the tantalum oven in a vacuum. Heating caused the diffusion of cesium fission products from the graphite. Vacuums are common to mass spectrograph systems. In isolating the cesium-145 isotope it was used to avoid collisions between cesium atoms and other atoms present in air and to lessen the chance that the cesium would be deflected from its path.

The cesium atoms diffuse through the porous graphite and come in contact with the oven walls. Upon contact they are ionized (they lose an electron resulting in a positively charged cesium ion), and then accelerated through the electrical and magnetic lens system of the spectrograph. The spectrograph, tuned to accept cesium, sorts the isotopes and fans them out into a spectrum along the focal plane which is lined with mylar. Beta counters are then used to measure the radioactivity on the Mylar. "We observed the activity of many isotopes and we found activity at the mass 145 position," said Balestrini.

Until the American and French experiments were conducted, cesium-145 was but one of many unknown short-lived products resulting when uranium-235 is fissioned. The chemical properties of cesium are such that it diffuses more readily than most other elements and it is more easily ionized. These properties were used advantageously in the Los Alamos and French experiments to isolate the isotope for study.

The American experiment was started by Forman in 1967 at the Aberdeen Proving Ground, Md. Forman was then a member of the U.S. Army Signal Corps stationed at the Ballistics Research Laboratories. He obtained a government surplus spectrograph to begin this work. After he was discharged and employed at the Los Alamos Scientific Laboratory, he arranged for the transfer of the spectrograph to Los Alamos.

Photo Shorts

Two numerically controlled turning and boring machines were delivered to the LASL Shop department from Detroit in a pair of climate-controlled vans. Purchase of the vans by Mayflower was suggested by the Laboratory, according to Horace Noyes, SP-DO. Noyes noted that temperature changes during transit cause expansion and contraction of precision-built electronics components, such as those on the Shop department machines and computers, and can result in serious misalignment. Noyes said the Laboratory supported its request for climate-controlled vans with a graph prepared by ENG-6 which shows heat transfer characteristics of a standard van at various temperatures. (Photo by Bill Jack Rodgers)

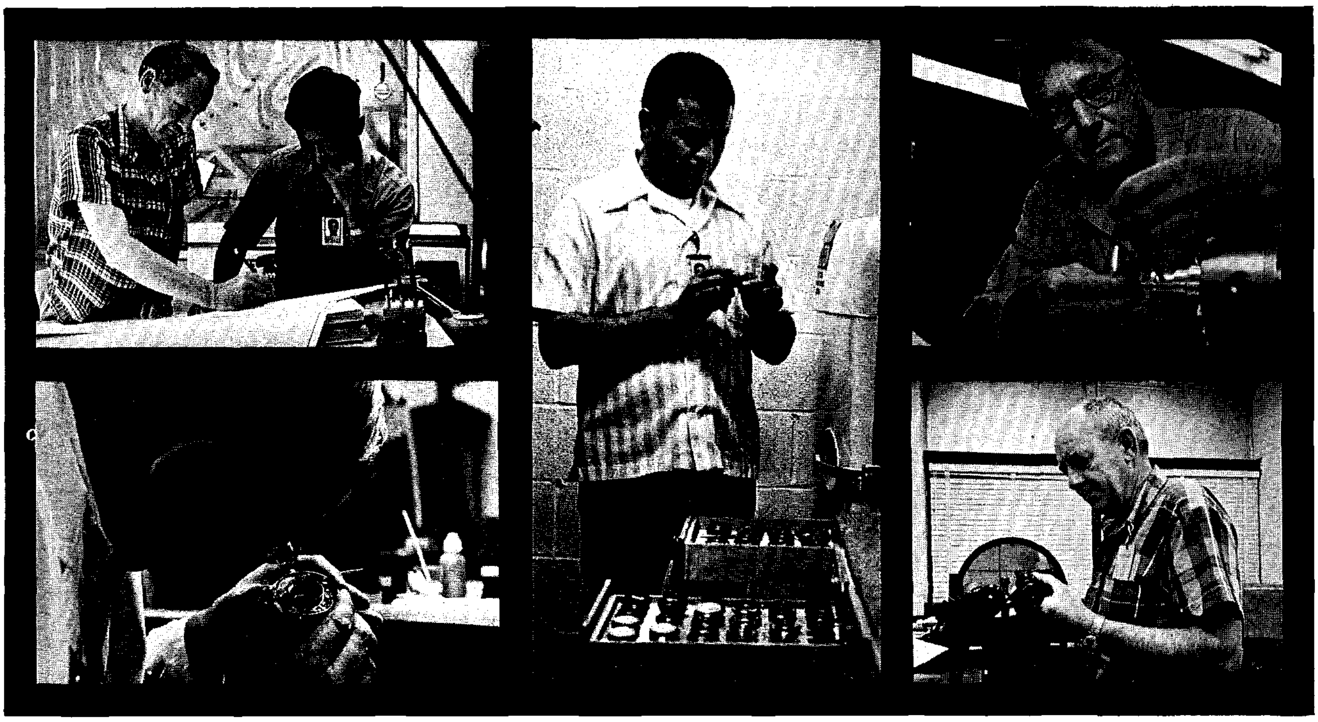
A bear was eating his early morning breakfast all too often from Frank Berry's garbage can. The noise was disquieting and having to upright the can and pick up its spilled contents was annoying. Berry, a member of ISD-7, set up a camera and a pair of flashing light units connected to a microswitch on the bottom of the garbage can. When the bear tilted the can, the light units flashed. Berry ended up with this picture and the bear hasn't been back since.

So many file drawers were stacked in a hallway of the Administration building that there seemed to be no room for another one. Looking for a place is Al Peaslee of TD-2. The file drawers were moved to a warehouse where they will be used to store archive documents for the Mail and Records group. (Photo by Bill Jack Rodgers)

Members of ISD-7 recently decorated the walls of the main corridor of the Administration building with photographs depicting Laboratory activities. Among those on display are prize winning photographs judged during the annual contest of the Industrial Photographers of the Southwest. Mounting the display are Bob Martin, Henry Ortega, Associate Group Leader Bob Perlee, and Jose "Mitzie" Ulibarri. (Photo by Bill Jack Rodgers)

The hummingbirds near Questa are friendly, or at least they are at a nearby cabin owned by Ivan Worthington's father-in-law. The cabin owner routinely maintains several bird feeders. Worthington, a member of ISD-7, concealed the feeders and, after about an hour, coaxed a hummingbird to drink some glucose water from a hand-held glass.

It's not a movie set. Bob Brashear, right, manager of the Bradbury Science Hall, is explaining to Actor Ernest Borgnine what will take place in the experimental building at the Los Alamos Meson Physics Facility when it is completed. Borgnine toured the Science Hall, LAMPF and the Health Research Laboratory during his recent visit to Los Alamos. (Photo by Bill Jack Rodgers)



Teaming Up on the Optics

Normally you wouldn't think of going to an explosives division to have a camera repaired. But that's the way it is at the Los Alamos Scientific Laboratory. Group GMX-9 can do anything with photographic and optical instrumentation from cleaning, general maintenance, repairing and modifying to design and fabrication.

Since its beginning as Project Y, the Laboratory has always had a group to service its optical and photographic instrumentation. The first group was formed in 1943 and was a part of X-division. In 1944 it was known as Group E-2 and in the same year it became Group G-11. In 1946 it was known as Group M-8 and in 1948 it was designated GMX-9.

GMX-9 is headed by Berlyn Brixner who has weathered all of the group's designations since 1943. "At the start we not only serviced the optical and photographic instrumentation here, but we were the photography group for the whole project," he said. "During the war we were too busy meeting the goals of Project Y to invent anything. We applied known principles of photography to the diagnostic work we were doing in explosives. We fixed cameras and we built them, but they were patterned after other cameras for the most part." When Brixner arrived at Los Alamos after 10 years as a regional photographer for the Soil Conservation Service, a sweeping-slit-image rotating-mirror camera was being built for investigations of explosion phenomena. "It was patterned after a camera that had been built by Professor J. W. Beams at the University of Virginia," he said.

"After the war people wanted better cameras for studying explosion phenomena. Recording information from an oscilloscope screen was not a well-developed specialty. We built 350 oscilloscope cameras, most of them after the war, and many of them are still in use."

Brixner also designed and built several high-speed cameras capable of taking pictures at rates up to seven million frames per second which are used in LASL's studies of explosives. Many of his designs for rotating-mirror streak cameras and rotating-mirror framing cameras have served as starting points for commercial production of equipment now used in research projects throughout the world. He has also been instrumental in the development of new methods of lens design on high-speed computers. In 1966 he received the E. I. du Pont Gold Medal Award from the Society of Motion Picture and Television Engineers in recognition of his work in high-speed photography, photoinstrumentation and automatic lens design.

The need for a group like Brixner's grew out of requirements for graphic diagnostic capabilities in explosives. The focal point of its efforts is still in this field. The group fulfills the specialized needs of GMX-division for photographic and other optical instrumentation and also offers its services across the board to all other groups at the Laboratory.

"We work on a job order basis unless it's some trivial thing that will take less than a hour to do. Then we do it on the spot," Brixner said. "We only make things we can't buy and we don't get involved in electronics problems. For these problems we depend on electronics people at the Laboratory."

All cameras purchased by the Laboratory are sent to GMX-9 by the Supply and Property department before they are assigned to the users. The optics group attaches a red metal tag to each camera which bears its property number. The tag is the camera's "badge." Without it security guards will not allow it inside restricted areas. Brixner's group is best qualified to know where to put the tag on a camera body so the rivets with which it is attached will not interfere with the instrument's intricate mechanism or produce a "leak" in its light-tight interior. Access to all of the Laboratory's new cameras allows GMX-9 to keep accurate records on their locations and their types so that appropriate service manuals can be kept in stock.

The group also stocks a large assortment of parts, loan equipment and replacement components including a wide range of shutters for most types of cameras.

For the work required of the group, Brixner has assembled a team of top-notch specialists who are familiar with all types of optical instrumentation used at the Laboratory. His group now numbers seven, including himself and a half-time secretary, Gayle Thomas. Others are Bob Lapp, Barry Lenhart, Baudino (Buddy) Montoya, Ken Imamura and Bill Wynne.

Lapp came to the Laboratory eight years ago after 20 years in the U.S. Navy where he worked with optical systems such as gunsights, periscopes

continued on next page

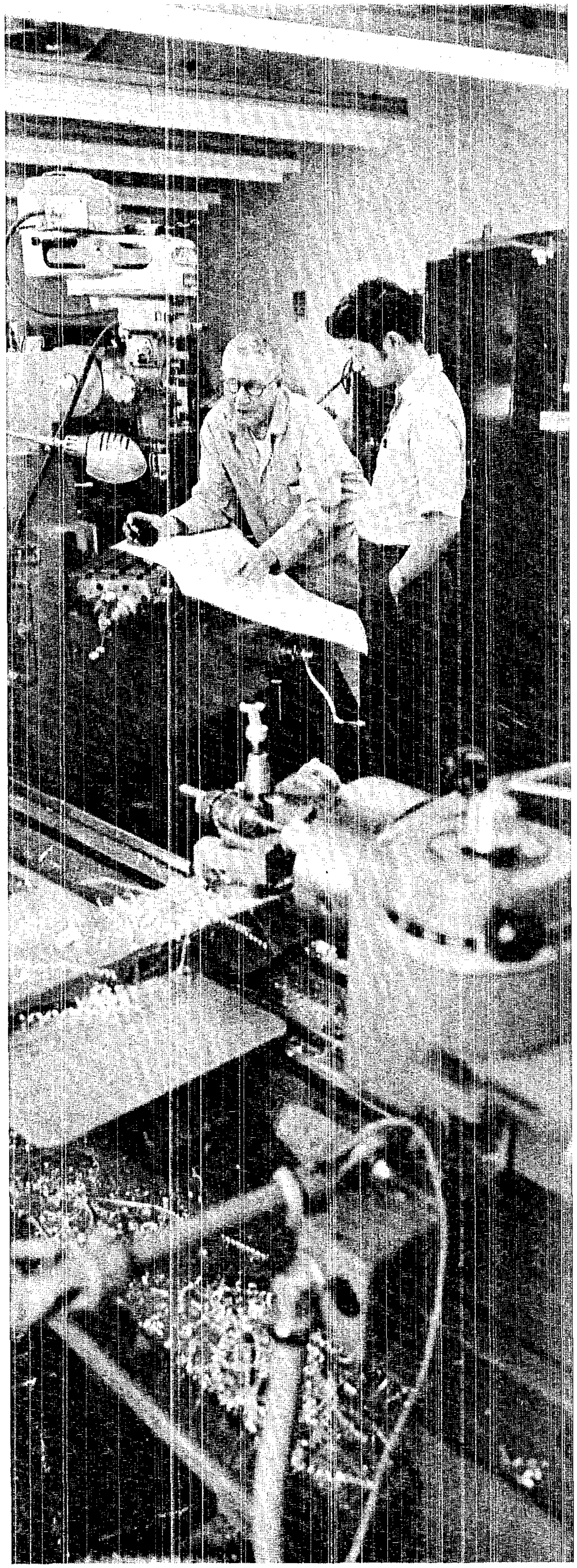
Bob Lapp works with a machine used to grind smooth surfaces.

Buddy Montoya and Secretary Gayle Thomas check files in the GMX-9 stock room for the repair record of an optical instrument.

and binoculars. At LASL his background is being put to good use in working with such instruments as spectroscopes, microscopes, film readers, telescopes, periscopes and binoculars. Lapp built an apparatus for aligning binoculars and camera rangefinders which was patterned after one used by the Navy. In addition he does cutting and polishing of optics and chromeplating of such things as mirrors.

Lenhart also received his training in the Navy. He was first a photographer and then was trained in the repair of cameras and other photographic equipment. Lenhart has been at Los Alamos for four years and is now GMX-9's chief repairman for cameras, exposure meters, projectors and most other types of photographic instrumentation. He also does thin-film vacuum evaporation processing. This is a process for providing the thin reflective surfaces on mirrors and anti-reflective coatings on lenses.

Montoya has been employed by the Laboratory since 1954. Until 1962 he was a property representative for photographic supplies and stationery for SP-3. He then transferred to GMX-9 as a property representative in its stockroom. He still maintains the stockroom, but has since learned to repair



cameras, microscopes and other optical instruments. Much of his time is spent in the repair and overhauling of oscilloscope cameras and others which were built at the Laboratory.

Imamura is the group's draftsman. Educated at the Oregon Technical Institute, Imamura has been with GMX-9 for more than four years and has learned to work with computer codes in the design of lenses under Brixner's supervision. He prepares illustrations and engineering drawings for lenses, new instruments, instrument modifications and replacement parts.

Wynne is actually a member of SD-5. He has been a machinist at LASL for 19 years and has operated the GMX-9 branch shop for the past 10 years. His early experience made him a prime candidate for work with the GMX-division optics group. Before coming to the Laboratory, Wynne was a machinist for Warner Brothers and for Heiland Research (now Minneapolis Honeywell) in Denver, Colo.

"We all work as a team," said Brixner. "Many jobs require more than one of our specialists and sometimes all of them—if not in the job itself, in making the tools or test equipment we need to do the job. We make a lot of the equipment we need to work with in addition to many of the optical instruments required by groups at the Laboratory."

An early test instrument built by the group was a special interferometer. It is being used to test the quality of laser rods—the laser's principal optical element which is responsible for the amplification of light into an intense pencil-thin beam.

The interferometer uses a laser light source, whose beam is split by mirrors and subsequently reunited after traversing different optical paths. The laser rod being tested is positioned in one of these paths. When the beams are reunited the resulting light pattern gives an indication of the quality of the rod.

One of the many instruments designed by GMX-9 to meet special requirements was a lens system for J-15's solar eclipse camera. The J-division group needed the lens to take exacting photographs of the sun's corona. It had to be a lens system that would produce exact point-to-point correspondence between the corona and its image on film. Because it was to be used in an aircraft where room was at a premium, it could be

continued on next page

Draftsman Ken Imamura goes over the design of a part with Machinist Bill Wynne.

Lapp, Group Leader Berlyn Brixner, and Barry Lenhart work with the interferometer used to test the quality of laser rods.

no longer than 24 inches. A high quality image throughout a six-degree flat image field was needed. High light transmission and freedom from flare were essential. No commercial lens meeting these specifications was available.

Brixner's group used one of its computer codes in coming up with the proper design of a multilens system. When completed the instrument measured only 18 inches in length.

The lenses were not made by Brixner's group. None are. GMX-9 builds the lens tubes and other mechanical components necessary for the system, and designs the optics for it, but the lenses are made by commercial manufacturers. "We supply the specifications and glass from our own stock," said Brixner. "We stock our own glass because we must know its refractive index." The group leader noted that the refractive index of glass varies with each shipment and influences the design of a lens. The refractive index is the ratio of the velocity of light in air to its velocity in the glass.

A recent job order completed by GMX-9 illustrates there is sometimes only a fine line between definitions of "repair" and "fabricate." Image quality on a GMX-11 film reader needed to be improved and the Laboratory's optics group was asked to repair it. "We went out to the site where the reader was located," Brixner said. "We looked at its mechanics and borrowed the instruction book for it to see how the optical components were put together. Some of the mirrors were too thin—they weren't flat enough—causing distortion of the image. We cleaned and aligned the machine's condensing and illumination system and its mirrors immediately so GMX-11 could continue to use it. We had to build some jigs to align the optical elements properly because there were no alignment indicators on the machine. Then we replaced some of the mirrors. One was larger than any we had and of a complex shape so we had to design one and order it built to our specifications. Everyone got involved in this job."

GMX-9 cooperated with C-division to develop a scheme for making color motion pictures of computer-generated images. A current problem involves adapting a Mitchell motion picture camera to work on C-division's SC-4020 plotter/printers. Movie cameras generally run at constant speeds, but C-division needs one which will stop and start on demand so film frames on the same roll can be exposed for different lengths of time. The optics group is working with the computer division on this problem and together they are adapting the pin-registered Mitchell camera to the electrical demands of the printer/plotters. The camera's pin-registration system will position each film frame precisely and thereby avoid "jittery" images when the film is projected on a screen.

These are but a few of the knotty problems attacked by GMX-9. They show photographic and other optical instruments are deeply ingrained in the Laboratory's research and development work. There are literally hundreds of optical instruments in use, more than enough to keep a seven-member group busy all of the time.

short subjects

The Users Group of the Los Alamos Meson Physics Facility will hold its annual general meeting at Los Alamos Nov. 8-9. At the business meeting, members will hear several invited papers and new officers will be announced. Other activities will include a tour of the accelerator facility, sub-group meetings, and a review of plans for secondary beams and experimental facilities.

Philip Koontz, N-2, has retired after nineteen years with the Laboratory. He worked on the Manhattan Project from 1943 to 1946. He returned in 1955 and worked in N-division until his recent retirement. Koontz was a member of the team working with Enrico Fermi on the first nuclear chain reaction at the University of Chicago. He and his wife, Florence, live in Los Alamos.

Eskild Hansen, SD-5, retired after 17 years at LASL. He began work with SD-1 in 1954. He transferred to GMX-3 for a brief period and then returned to SD-1. In 1962 he transferred to SD-5 where he was employed until his retirement. Hansen and his wife, Henrietta, live in Espanola.

Eric L. Peterson, GMX-4, retired after nearly 25 years with the Laboratory. He began work for Group M-4. He transferred to GMX-4 in 1948. He and his wife, Marian, live in Espanola.

Lawrence Rohrer, SD-4, retired after 22 years with the Laboratory. He was employed by ENG-3 in 1949. He transferred to the Shop department two months later. He first served in SD-3 and SD-1. He and his wife, Ethel, live in Los Alamos.

Louis Goldstein, T-10, retired after nearly 25 years with T-division. He joined the Laboratory in 1946. He and his wife, Ella, live in Los Alamos.

Steve Cordova, H-4, retired after nearly 11 years at the Health Research Laboratory. Cordova and his wife, Anna, live in Los Alamos.

Fred Tesche, a former LASL employee, has been appointed the Atomic Energy Commission's scientific representative in London. He assumed the position this month, succeeding William Rice who has returned to AEC headquarters in Washington.

Tesche is located at the U.S. Embassy in London and is responsible for liaison with authorities of the United Kingdom relative to the United States' cooperation in the peaceful uses of atomic energy. His regional responsibilities include Ireland, Denmark, Norway, Sweden and Finland.

The physicist was employed at LASL for 17 years. From 1965 until 1969, when he left Los Alamos, he was MP associate-division leader and MP-5 group leader.

Michael Hane, a J-10 employee from 1961 to 1963, died recently as the result of injuries received in an avalanche in Peru.

Hane participated in Operation Dominic, a series of atmospheric tests conducted in the South Pacific in 1962. He was a former member of the Mountaineers, a local mountain climbing club.

He is survived by his wife, Julie, and one son, Joshua.

John Hopkins has been appointed Atomic Energy Commission representative to the Geneva Conference of the Committee on Disarmament (CCD).

Hopkins, a senior staff member in P-division assigned to the Director's office as an assistant for research, is currently in Geneva doing work relevant to his AEC post. In February, he and his family will go to Geneva for several months while Hopkins participates in the CCD negotiations.

Hopkins is one of two AEC representatives to the CCD from LASL. **James McNally,** TD-4, has served in this capacity for about three years.

the technical side

Taken from LASL Technical Information Reports submitted through ISD-6

Meeting of the American Association of Pathologists and Bacteriologists, Montreal, Canada, March 6-9:

"Early Ultrastructural Effects of Ionizing Radiation" by S. W. Jordan, University of New Mexico, Albuquerque, P. N. Dean, H-4, and J. Ahlquist, H-8

Fifth Nordic-Dutch Accelerator Symposium, Ebeltuft, Denmark, May 18-22:

"Two-Nucleon Transfer Reactions and Elementary Excitations (An Experimental Survey)" by O. Hansen, P-DOR (invited)

American Physical Society Topical Conference on Collisionless Shocks, Los Alamos, June 14-15:

"Theory of Laminar Collisionless Shocks" by D. W. Forslund and J. P. Freidberg, both P-18

"Electron Cyclotron Drift Instability and Turbulence" by D. W. Forslund, R. L. Morse, C. W. Nielson, all P-18, and J. H. Fu, EG&G

Summer Seminar on Nonlinear Eigenvalue Problems, Santa Fe, June 14-July 4:

"Existence and Stability of Branch Solutions of the Taylor Problem of Superposed Fluids: Steady State" by G. H. Pimbley, T-DOT (invited)

Molecular Spectroscopy Symposium, Ohio State University, Columbus, June 14-18:

"Vibrational Spectrum and Force Field of Ruthenium Tetroxide" by R. S. McDowell, CNC-4, and L. C. Hoskins, University of Alaska, Fairbanks

International Atomic Energy Agency Fourth Conference on Plasma Physics and Controlled Nuclear Fusion Research, Madison, Wisc., June 17-23:

"Z-Pinch Experiments with Shock Heating" by D. A. Baker, P-18, L. C. Burkhardt, J. N. DiMarco, A. Haberstitch, H. J. Karr, J. A. Phillips, A. E. Schofield, P. R. Forman, all P-14, and L. W. Mann, P-18

"Theory of Turbulent Heating and Anomalous Diffusion in Pinch Plasmas" by D. W. Forslund, R. L. Morse and C. W. Nielson, all P-18

"High Energy Gun-Injected Toroidal Quadrupole" by J. E. Hammel, I. Henins, J. Marshall, all P-17, and R. W. Kewish, Jr., P-16

"Theta-Pinch Experiments with Helical Equilibrium Fields in a Five-Meter Toroidal Sector and in a Three-Meter Linear Device" by S. C. Burnett, W. R. Ellis, C. R. Harder, F. C. Jahoda, W. E. Quinn, A. S. Rawcliffe, F. L. Ribe, G. A. Sawyer, R. E. Siemon, K. S. Thomas, E. L. Zimmermann, all P-15, and C. F. Hammer, H. W. Harris, both P-16

"Recent Studies of Dense Plasma Focus" by J. W. Mather, P. J. Bottoms, J. P. Carpenter, K. D. Ware and A. H. Williams, all P-7

"Survey of Scyllac Theory" by J. P. Friedberg, P-18

Fourteenth Meeting of COSPAR (Committee on Space Research), Seattle, Wash., June 17-July 2:

"The Effects of Dose Protraction on Hematopoiesis in the Primate and Dog" by J. F. Spalding, L. M. Holland and J. R. Prine, all H-4 (invited)

"Results of Polarization Observations of the Outer Corona from a Jet Aircraft" by C. F. Keller, J-15

"Some Newly Discovered Coronal Emission Lines from High Altitude Infrared Observations of the March 7, 1970, Solar Eclipse" by K. H. Olsen, C. R. Anderson and J. N. Stewart, all J-9

Colloquium, Nuclear Engineering Science Division, Rensselaer Polytechnic Institute, Troy, N.Y., June 18:

"The Storage Ring as a High Intensity Source" by R. R. Fullwood, W-8

Seminar, Nuclear Research Center, Karlsruhe, Germany, June 18:

"Plutonium Fuel Studies at Los Alamos Scientific Laboratory" by J. A. Leary, CMB-11 (invited)

Seminar, Air Pollution Control Office, Raleigh, N.C., June 18:

"Loss of Long-Range Visibility in an Open Air Laboratory" by D. H. Liebenberg, P-8 (invited)

Fifth Symposium on Temperature—Its Measurement and Control in Science and Industry, Washington, D.C., June 21-24:

"Grooved Melt Wires for Temperature Measurement of Nuclear Fuel" by P. G. Salgado, GMX-3, B. J. Thamer, Dir. Off., R. L. Rudman, IBM Data Processing Division, Los Angeles, Calif.

"Thermometry Below 0.1 K: A Comparison of the Mössbauer Effect Thermometer and the Gamma-Ray Anisotropy Thermometer" by R. D. Taylor, P-8

"Resistance Thermometry with Thin Superconducting Aluminum Films" by D. H. Liebenberg, P-8, and L. D. F. Allen, CNC-4

"The Application of Nuclear Orientation to Ultra Low Temperature Thermometry" by W. A. Steyert, P-8

"Development of a Nuclear Radiation Tolerant Resistance Thermometer" by C. R. Tallman, N-4

"High Temperature Core Thermocouple Development for the Nuclear Rocket Engine Program (Rover)" by B. G. Goodier, C. R. Tallman, both N-4, and R. J. Fries, N-1

Atomic Energy Commission Nuclear Accident and Radiological Incident Training Course, Albuquerque, June 22-25:

"Medical Aspects of Radiation Accidents" by G. L. Voelz, H-DO

Tenth Biennial Conference on Carbon, Lehigh University, Bethlehem, Pa., June 27-July 2:

"The Dependence of Young's Modulus on Porosity in a Series of Isotropic Graphites at Elevated Temperatures" by P. E. Armstrong, CMB-13

"High Temperature Creep of a Poco Graphite" by W. V. Green and E. G. Zukas, both CMB-13

"The Use of Gamma-Alumina-Polymerized Furfuryl Alcohol Resin Binders in the Fabrication of Graphite" by E. M. Wewerka and J. M. Dickinson, both CMB-13

Gordon Research Conference on Plasma Physics, Andover, N.H., June 28-July 2:

"Anomalous Microwave Absorption Near the Plasma Frequency" by H. Dreicer, D. B. Henderson and J. C. Ingraham, all P-13

"Studies of Anomalous Resistivity by Numerical Simulation" by C. W. Nielson, P-18

"Electron Cyclotron Drift Instability and Turbulence" by R. L. Morse, P-18

Summer Workshop on Experiments with Nuclei at the Zero Gradient Synchrotron, Argonne National Laboratory, Ill., June 28-30:

"Experiments Proposed for LAMPF" by R. L. Burman, MP-7 (invited)

Air Pollution Control Association Meeting, Atlantic City, N.J., June 28-July 1:

"Particle Size, Visibility and Mass Concentration in a Non-Urban Environment" by H. J. Ettinger and G. W. Royer, both H-5

International Working Sessions on Fusion Reactor Technology, Oak Ridge, Tenn., June 28-July 2:

"Facility for Duplicating 14 MeV Neutron Effects for Fusion Power Reactors" by D. B. Henderson and H. Dreicer, both P-13

Twelfth Annual Meeting, Institute of Nuclear Materials Management, West Palm Beach, Fla., June 29-July 1:

"Radioactive Sources for Safeguards, Materials Management and Process Control" by H. O. Menlove, R. A. Forster, L. V. East and J. E. Foley, all A-1

"Active Assay of Fissionable Materials at the Los Alamos Nondestructive Assay and Standards Laboratory" by M. M. Thorpe, R. H. Augustson, J. H. Menzel, A. E. Evans, D. B. Smith and C. R. Weisbin, all A-1

"Passive Assay--Innovations and Applications" by J. L. Parker, T. D. Reilly, J. E. Foley, R. B. Walton and L. V. East, all A-1

"Field Assay Experience with the MONAL at National Lead Company of Ohio" by J. H. Menzel, T. D. Reilly, J. L. Parker, J. E. Foley, all A-1, and B. R. Dennis, ENG-6

International Symposium of Thermochemistry, Marseille, France, June 30-July 2:

"Enthalpy of Formation of Neptunium Monocarbide" by E. J. Huber, Jr. and C. E. Holley, Jr., both CNC-2

Seminars at the Swiss Technical Institute, Zurich, Switzerland, July 2, and University of Munich, West Germany, July 12:

"Optical Potential Studies at Los Alamos with 15-Million-Electron-Volts Tensor Polarized Deuterons" by P. W. Keaton, Jr., P-DOR

Eighth International Shock Tube Symposium, Imperial College of Science and Technology, London, England, July 5-8:

"A Shock Tube Study of the Decomposition Kinetics of Nitrous Oxide" by L. S. Blair and R. W. Getzinger, both GMX-7

Second International Symposium on Gas Kinetics, University College of Swansea, England, July 5-9:

"Density Gradient Measurements of Oxygen Dissociation in Shock Waves" by W. D. Breshears and P. F. Bird, both GMX-7

Thirteenth Annual Meeting, American Association of Physicists in Medicine, Houston, Texas, July 7-9:

"Can Negative Muons Provide Unique or Better Diagnostic Information?" by A. S. Lundy, MP-1, and R. L. Hutson, MP-7

"Recent π^- Depth Dose Distribution Calculations" by R. L. Hutson, MP-7

1971 SECEDE Summer Study, Sandia Laboratories, Albuquerque, July 8:

"High Altitude Striation Theory" by S. R. Goldman, J-10

Second Workshop of Personnel Neutron Dosimetry, New York, N.Y., July 8-9:

"Studies in Personnel Neutron Dosimetry" by D. E. Hankins, H-1

Symposium on Nuclear Three Body Problem and Related Topics, Budapest Hungary, July 8-11:

"Elastic Scattering and Breakup of 15-Million-Electron-Volts Polarized Deuterons" by P. W. Keaton, Jr., and D. D. Armstrong, both P-DOR

Sixteenth Annual Meeting, Health Physics Society, New York, N.Y., July 12-16:

"Measurements of 'Structure' X Rays from a Pulsed 5 MeV Accelerator" by J. R. Parker, MP-1, and M. J. Engelke, Sr., H-1

"High-Intensity Electron Accelerator Radiation Hazards" by J. R. Parker, MP-1, and M. J. Engelke, H-1

"Correction Factors for 9 and 10 inch Sphere Neutron Instruments and one inch Diameter BF3 Tubes Used in Small Beams and Slits" by D. E. Hankins and G. W. Neely, both H-1

"Study of a Thermal Neutron Calibrator" by D. E. Hankins, H-1

"Rulison Reviewed—A Health Physics Viewpoint" by A. J. Ahlquist and J. E. Dummer, Jr., both H-8

"Gamma-Insensitive Air Monitor for Radioactive Gases" by R. A. Jalbert, H-1, and R. D. Hiebert, P-1

"Protection Factors for Respirators" by E. C. Hyatt, J. A. Pritchard and C. P. Richards, all H-5

"A Beam-Spill Monitor System for an 800 MeV Proton Accelerator" by J. R. Parker and J. D. Easley, both MP-1, J. D. Oetting, Massachusetts Institute of Technology, Cambridge, and J. H. Richardson, T-DOT

"Sampling for Plutonium-238 to Estimate Lung Deposition" by H. J. Ettinger and W. D. Moss, both H-5, and L. J. Johnson, H-1

U.S.-U.S.S.R. Peaceful Nuclear Energy Technical Talks, Washington, D.C., July 12-15:

"Residual Atmospheric Radioactivity from Nuclear Testing" by G. A. Cowan, CNC-DO

Gordon Research Conference on Nucleic Acids, Proctor Academy, Andover, N.H., July 12-16:

"The Role of Pyrimidine Clusters in Transcription" by D. A. Smith, H-4

20 years ago in los alamos

Culled from the September, 1951, files of the Los Alamos Herald by Robert Porton

Benefit Contest Promises Antics

In what might be the most unusual ball game of the season—or any season—S Site, state softball champs, will meet the Los Alamos Bombers, local hard-ball team, in a combination baseball-softball game on the North Mesa field. The action will be unique in Hill sports history. When at bat, S Site will have to hit baseball pitching and run regulation bases. The Bombers will have to hit Bun Ryan's softball pitching and run the shorter bases. Proceeds will go toward sending S Site to the regional tourney in Casper, Wyo.

New Bridge Open to Traffic

The new high-level bridge spanning Los Alamos Canyon will be open to traffic this weekend, the AEC announced. Holders of project passes will now be able to enter Los Alamos over three roads. The Finney and Turnipseed Company of Topeka, Kans., was architect engineer and the Vinson Construction Company, Phoenix, Ariz., built the open-spandrel, steel-arch structure, outbidding 14 other firms with its $704,781.94 bid. The bridge has a width of 44 feet, is 820 feet long and has a 422-foot span.

Elmo R. Morgan Resigns

The resignation of Elmo R. Morgan as Los Alamos Field Manager of the AEC was announced. Morgan has accepted a position as coordinator of cooperative research at the University of Utah, Salt Lake City. He will be succeeded by Ralph P. Johnson, field manager for SFO at Las Vegas, Nev.

Local Chemists at National Conclave

Many members of the Los Alamos Scientific Laboratory staff are attending the world chemical conclave in New York City. The meetings mark the 75th anniversary of the founding of the American Chemical Society, as well as the 16th Conference of the International Union of Pure and Applied Chemistry. Local scientists attending include C. W. Christenson, J. D. Perrings, Charles Holley, Elmer Huber, Jr., Adam Schuch, Charles Metz, Thomas Sandenaw, Frank Dunn, Maynard Smith, James Bertino, William McCreary, Robert Phelps, John Mosely, John Sullivan, Fred Edeskuty, Angelo Georgi, Edward Onstott, Roy Krohn, Willard Witteman, Conrado Gutierrez, Richard Money, Arthur Briesmeister, Sherman Rabideau, Larned Asprey, Alfred Zeltmann, Jean McClelland and Helen Cowan.

what's doing

LOS ALAMOS FILM SOCIETY: 7:30 p.m., Civic Auditorium. Admission: members—$.50, others—$2.
Sept. 29—"New Cinema I."

OUTDOOR ASSOCIATION: No charge, open to the public. Contact leaders for information.
Sept. 1—Picnic and meeting, 6 p.m., Bandelier, Reed Elliott, 662-4515.
Sept. 4-6—Chicago Basin to Vallecitos, Walter Green, 672-3203.
Sept. 18-19—Crested Butte to Aspen, Colo., Don Liska, 662-3665.

SPORTS CAR CLUB DEL VALLE RIO GRANDE: Meeting first Tuesday of each month at the Los Alamos National Bank, 7:30 p.m. For information call Bill Hutchinson, 662-5325.

SIERRA CLUB: Luncheon meeting at noon, first Tuesday of each month, South Mesa Cafeteria. For information call Brant Calkin, 455-2468, Santa Fe.

MESA PUBLIC LIBRARY:
Sept. 1-29—Pen and ink drawings, Doyle Davis.
Sept. 1-21—Christmas Store, lobby case display, Church Women United.

PUBLIC SWIMMING: High School Pool—Monday through Wednesday, 7:30 to 9 p.m., Saturday and Sunday, 1 to 6 p.m., Adult Swim Club, Sunday, 7 to 9 p.m.

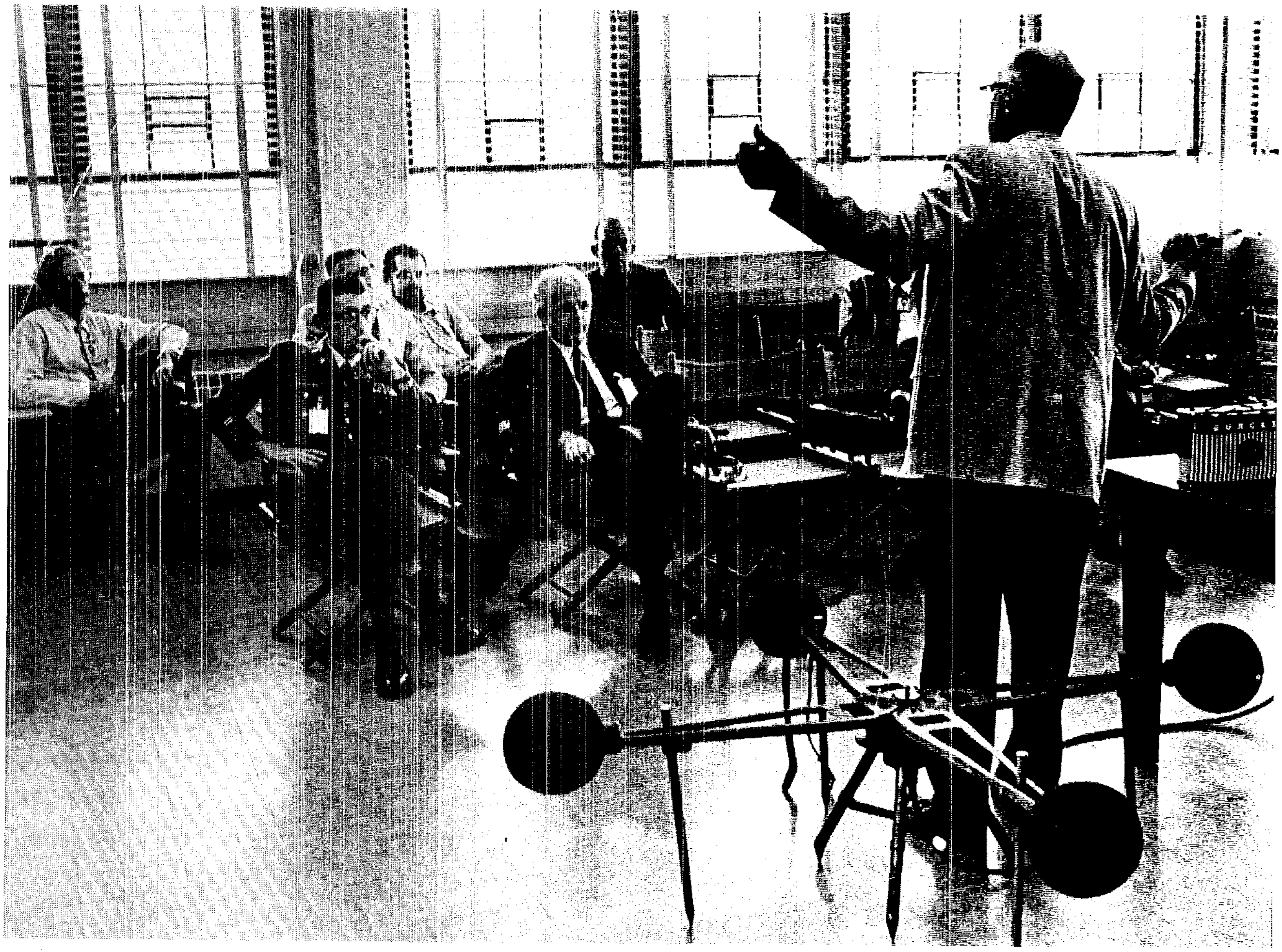
MOUNTAIN MIXERS SQUARE DANCING CLUB: For information call Mrs. Florence Denbow, 662-5014.
Sept. 4—Mesa School, 8 p.m., Charles Hartley, Roswell, caller.
Sept. 18—Mesa School, 8 p.m., "Bones" Craig, Los Alamos, caller.

NEWCOMERS CLUB: Sept. 22, 7:30 p.m., Los Alamos National Bank, speaker to be announced. For information call Sally Jacoby, 662-4862.

RIO GRANDE RIVER RUNNERS: Meetings scheduled for noon, second Friday of each month at South Mesa Cafeteria. For information call Joan Chellis, 662-3836.

John Rowley, N-7 group leader, explains preliminary studies conducted on nuclear subterrenes at the Laboratory to William McElroy, director of the National Science Foundation. While visiting LASL, McElroy announced his plans to resign from the Foundation and to accept the appointment as chancellor of the University of California at San Diego. The nuclear subterrene is a device capable of melting its way through solid rock. To the right of McElroy is LASL Director Harold Agnew and Glen Graves of the director's office.

Henry T. Motz
3187 Woodland
Los Alamos, New Mexico 87544



Robert Freyman, P-1, demonstrates the use of the acoustical mortar locator for Marvin Lasser, the U.S. Army's chief scientist. Seated next to Lasser is his aide, Lieutenant Colonel William Gaillourakis. The mortar locator was designed by Freyman and Frank Engels, a visiting staff member, and is being used in Vietnam.